Journal of the Society of Arts.

FRIDAY, AUGUST 24, 1866.

Announcements by the Council.

EXAMINATIONS, 1867.

The Programme of Examinations for 1867 is now published, and may be had *gratis* on application to the Secretary of the Society of Arts.

Proceedings of Institutions.

LLANELLY MECHANICS' INSTITUTION.—The nineteenth annual report, presented at the annual general meeting, held on the 24th of April last, says that for five years past there has been a steady increase in the income of the Institution. The balance-sheet shows an excess of receipts over expenditure in the year of £75 4s. There was a balance of £35 8s. 2d. in hand from the previous year, and the receipts from subscriptions were £191 19s. 6d. 59 fresh members have been added during the year. The present list shows nearly 600 members, and of these 549 are annual subscribers. The occupations of the present members are given in the following return, which shows a considerable increase of engine-fitters, iron-workmen, and potters, viz.:—107 agents and clerks, 87 fitters and smiths, 53 iron-workmen, 45 potters, 39 copper and lead-men, 32 merchants, 31 shopkeepers, 27 masons and carpenters, 19 mariners, 19 shopkeepers' assistants 18 colliers, 15 tin-plate workers, 13 teachers, 13 ministers of religion, 12 labourers, 12 ladies, 9 surveyors, 7 printers, 6 solicitors and surgeons, 5 magistrates, 5 innkeepers, 4 farmers, 3 painters, 3 members of Parliament, 3 army and navy officers, 3 police-constables, 3 shoemakers, 1 shipbuilder, total, 593. The reading-room is altogether inadequate to meet the growing requirements of the members, and is often overcrowded. Ten lectures were delivered in the session, viz., five prefessional lectures as follows:—On "Mania," by Rev. J. B. Owen, M.A.; on "The Nature of Good Food," by E. Lankester, Esq., M.D.; on "Wise Saws and Modern Instances," by the Rev. J. W. Lance; Readings, by the Rev. J. M. Bellew; on "Thomas Hood," by Walter Rowton, Esq.; and three amateur lectures; two Welch lectures were also given. The sum of £27 16s. 4d. was received for admission, while the disbursements amounted to £42 14s. 6d. In reference to the library, the statistics of circulation show a total increase of 825 issues for the year; the numbers being 5,324 as against 4,499 in the previous year. The largest increase has been in the section of science and art. During the last few years the income of the Institution has risen from £52 9s. 10d. to £191 19s. 6d. per annum, and the number of members has increased from 145 to nearly 600. The committee say:—"It is impossible to have watched the growth of the Institution year by year without feeling assured that one of the main springs of its great prosperity must be sought in the qualifications of the gentleman (Mr. Mainwaring) who has, during this period, filled the post of principal honorary secretary."

EXAMINATION PAPERS, 1866.

The following are the Examination Papers set in the various subjects at the Society's Final Examinations, held in April last:—

(*Continued from page* 626).

POLITICAL AND SOCIAL ECONOMY.

THREE HOURS ALLOWED.

Questions from Stephens's Commentaries.

1. Under what different heads does Stephens consider right in private relations.
2. How far is marriage in England a civil, and how far is it a religious contract?
3. What are by the common law the rights of the husband to the property of his wife, distinguishing between land, and money or other personal property?
4. At what time does the right of the father to the control over the persons of his children cease, and by what act may that control be sooner taken away?
5. What do you mean by Parliament?
6. What are the chief privileges of Parliament?
7. What is the title of her Majesty to the throne of this kingdom?
8. What are the duties of the Sovereign to the people, and how are they defined by the Coronation Oath?
9. Describe the offices of sheriff and coroner.

Questions from Professor Fawcett's Manual, for those who aspire to a First-Class Certificate.

1. How does Mr. Fawcett divide commodities with reference to the causes which regulate their price?
2. Give the history and explain the use of the co-operative system in its different forms.
3. What are the functions of credit, and is it rightly considered to be capital?
4. What determines the rate of wages, and why cannot this rate be permanently or beneficially affected by law?
5. What are the different advantages, according to different circumstances, of farming on a large and on a small scale?
6. Explain the incidence of the land tax, tithe rent charge, and rates chargeable on the occupation of land and houses. Is there any and what difference between land and houses in respect of this incidence?

GEOGRAPHY.

THREE HOURS ALLOWED.

1. Describe briefly the general distribution of high and low ground in Great Britain, naming the counties in which the principal hill-ranges are situated.
2. Mention, in the case of Great Britain and Ireland, the cities and towns that constitute great seats of manufacturing industry (cotton, woollen, linen, hardware, earthenware), naming the county to which each belongs; also name six or more of the principal seaports of Britain, describing their situations.
3. Describe briefly the physical geography of either France, Italy, or Germany—boundaries, mountains, plains, rivers-basins, and climate. (N.B. If you prefer it, draw a map of any one of those countries, embodying, as to natural features, the required information.)
4. Give some account of the Mediterranean Sea—naming the countries that lie around its basin, and the chief seaports situated on its shores.
5. Give a brief description of the physical features of India—distribution of high and low grounds, river-basins, &c., with the leading conditions of its climate.
6. Name the principal towns that lie within the valley of the Ganges—the valley of the Indus—on the plateau-lands of the Deccan—and upon the Malabar and Coromandel coasts respectively. Say which among them are most distinguished by size and population.
7. Specify the distinguishing conditions in the physical features, climate, and natural productions, of the Australian continent.
8. Draw a map either of New South Wales, Victoria, or Tasmania—marking on it the direction of the high grounds, courses of the principal rivers, and positions of the principal towns.
9. Describe briefly the natural features of New Zealand:

name also the provinces into which either island is respectively divided, with the chief town of each.

10. State the received conditions which account for the existence of ocean currents; name the principal currents of the Atlantic, describing particularly the course of the Gulf Stream.

11. To what causes are differences of climate to be chiefly assigned? Account for the differences in point of temperature between Tibet and the valley of the Ganges, between Lapland and Egypt, between the cities of Quito and Panama, between Central Africa and Polynesia.

12. Give some account of the geographical distribution of regions of subterranean disturbance (earthquakes and volcanic eruptions): name three or more of the principal active volcanos of either hemisphere, stating their localities.

ENGLISH HISTORY.

THREE HOURS ALLOWED.

1. Give the dates of the following events :—The landing of Cæsar in Britain; the invasion of the Anglo-Saxons; the mission of St. Augustine; the Norman Conquest; the Accession of Henry II.; Magna Charta; the Accession of Henry VII.,—of James I.; the flight of James II.; the Bill of Rights; the death of Queen Anne; the conquest of Wales; the union of Scotland; the union of Ireland.

2. What alterations were introduced into the administration of this country by the Normans?

3. Explain the dispute as to the right of investiture, in which William II. was involved.

4. Give a brief account of the objects of the dispute between Henry II. and Thomas à Becket.

5. Mention the principal clauses in Magna Charta.

6. What was the origin of the House of Commons? Show briefly what privileges it wrested successively from the sovereign, from its commencement to the reign of Henry VI.

7. What is meant by "The Royal Supremacy?" By whom was it first asserted? What did the kings of the Stuart line mean by the expression "The Royal prerogative?" How did the assertion of it bring out the opposite principle? When was it superseded?

8. State briefly what definite advantages were gained by Parliament for constitutional liberty, between 1625 and 1700.

9. Explain the purport of the two Acts of Settlement.

10. When did the party names of Whig and Tory arise? What is their origin? What names did they displace?

11. What was implied by the terms Jacobite, Nonjuror, Pretender? When did these names spring up, and when did they disappear?

*12. What were the effects of the French Revolution:—

(1.) On the two great political parties in England?
(2.) On the social condition of the lower classes here?

*13. What great changes have taken place in the industrial occupations of the working classes, in the 19th, as compared with the previous century? What have been the moral and social effects of such changes?

Special Subjects.

*** The first and second, or first and third, of these subjects to be answered, but not more.

1. The battle of Bouvines. The parties engaged in it, and its consequences.

2. A brief account of some of the more eminent men who flourished in the reign of Henry III.

3. An account of the controversy between Henry III. and his barons.

* Only one of these questions is to be answered.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, NOTTINGHAM, 1866.

The thirty-sixth meeting of the British Association commenced on Wednesday, the 23rd inst., under the presidency of William Robert Grove, Esq., Q.C., M.A., F.R.S.

The general committee met at the Mechanics' Hall at one o'clock, Professor Phillips, the retiring president, in the chair. The minutes of the last meeting at Birmingham were read and passed. The report of the council and the general committee was then read. It adds to the list of corresponding members the names of the following foreign men of science, viz.:—Captain Belavenetz, Geheimrath von Dechen, M. Gaudry, Prof. Grube, Prof. Kiepert, Prof. F. Romer, Chev. C. Negri, and Prof. Steenstrup. The names of Mr. J. Hind, F.R.S., and Mr. T. Close are added to the list of vice-presidents, and Mr. Thomas Archer Hirst, Ph.D., F.R.S., Professor of Mathematical Physics in University College, London, has been appointed joint general secretary. The report of the parliamentary committee consisted chiefly of complaints that the late session had passed without any steps being taken to promote the study of science in our public schools, while that of the Kew committee was very full and satisfactory, especially noting the appointment of a particular committee to consider and report on a comprehensive list of meteorological questions.

The number of members and associates enrolled up to Tuesday night was 1,290, and the receipts were £1,437. The number of members at Birmingham last year was 1,996, and the amount received was £2,227.

In the evening, at eight o'clock, Professor Phillips, the retiring president, having formally resigned the chair to his successor, Mr. W. R. Grove, that gentleman proceeded to deliver an address, of which the following are some of the most interesting portions:—

Every votary of physical science must be anxious to see it recognised by those institutions of the country which can to the greatest degree promote its cultivation and reap from it the greatest benefit. You will probably agree with me that the principal educational establishments on the one hand, and on the other the Government, in many of its departments, are the institutions which may best fulfil these conditions. The more early the mind is trained to a pursuit of any kind, the deeper and more permanent are the impressions received, and the more service can be rendered by the students.

Little can be achieved in scientific research without an acquaintance with it in youth; you will rarely find an instance of a man who has attained any eminence in science who has not commenced its study at a very early period of life. I desire to make no complaint of the tardiness with which science has been received at our public schools, and, with some exceptions, at our Universities. These great establishments have their roots in historical periods, and long time and patient endeavour is requisite before a new branch of thought can be grafted with success on a stem to which it is exotic. Nor should I ever wish to see the study of languages, of history, of all those refined associations which the past has transmitted to us, neglected; but there is room for both. It is sad to see the number of so-called educated men who, travelling by railway, voyaging by steamboat, consulting the almanac for the time of sunrise or full moon, have not the most elementary knowledge of a steam-engine, a barometer, or a quadrant; and who will listen with a half-confessed faith to the most idle predictions as to weather or cometic influences, while they are in a state of gross ignorance as to the cause of the trade winds or the form of a comet's path. May we hope that the slight infiltration of scientific studies, now happily commenced, will extend till it occupies its fair space in the education of the young, and that those who may be able learnedly to discourse on the Eolic digamma will not be ashamed of knowing the principles of an air-pump, an electrical machine, or a telescope, and will not,

as Bacon complained of his contemporaries, despise such knowledge as something mean and mechanical.

To assert that the great departments of Government should encourage physical science may appear a truism, and yet it is but of late that it has been seriously done; now, the habit of consulting men of science on important questions of national interest is becoming a recognised practice, and in a time, which may seem long to individuals, but is short in the history of a nation, a more definite sphere of usefulness for national purposes will, I I have no doubt, be provided for those duly qualified men who may be content to give up the more tempting study of abstract science for that of its practical applications. In this respect the report of the Kew Committee for this year affords a subject of congratulation.

I do not propose on this occasion to recapitulate the special objects attained by the Association, this has been amply done by several of my predecessors; nor shall I confine my address to the progress made in physical science since the time when my most able and esteemed friend and predecessor addressed you at Birmingham.

I purpose, with your kind permission, to submit to you certain views of what has within a comparatively recent period been accomplished by science, what have been the steps leading to the attained results, and what, as far as we may fairly form an opinion, is the general character pervading modern discovery.

I need not dwell on the common-place but yet important topics of the material advantages resulting from the application of science; I will address myself to what, in my humble judgment, are the lessons we have learned, and the probable prospects of improved natural knowledge.

One word will give you the key to what I am about to discourse on; that word is *continuity*, no new word, and used in no new sense, but perhaps applied more generally than it has hitherto been. We shall see, unless I am much mistaken, that the development of observational, experimental, and even deductive knowledge is either attained by steps so extremely small as to form really a continuous ascent; or, when distinct results, apparently separate from any co-ordinate phenomena have been attained, that then, by the subsequent progress of science, intermediate links have been discovered uniting the apparently segregated instances with other more familiar phenomena. Thus, the more we investigate, the more we find that in existing phenomena graduation from the like to the seemingly unlike prevails, and in the changes which take place in time, gradual progress is, and apparently must be, the course of nature.

Let me now endeavour to apply this view to the recent progress of some of the more prominent branches of science.

In astronomy, from the time when the earth was considered a flat plain bounded by a flat ocean—when the sun, moon, and stars were regarded as lanterns to illuminate this plain—each successive discovery has brought with it similitudes and analogies between this earth and many of the objects of the universe with which our senses, aided by instruments, have made us acquainted. I pass, of course, over those discoveries which have established the Copernican system as applied to our sun, its attendant planets, and their satellites. The proofs, however, that gravitation is not confined to our solar system, but pervades the universe, have received many confirmations by the labours of members of this Association; I may name those who have held the office of President—Lord Rosse, Lord Wrottesley, and Sir J. Herschel, the two latter having devoted special attention to the orbits of double stars, the former to those probably more recent systems called nebulæ. There is another class of observations quite recent in its importance, and which has formed a special subject of contribution to the Reports and Transactions of this Association; I allude to those on Meteorites.

Dr. Olmsted explained the appearance of a point from which the lines of flight of meteors seem to radiate, as being the perspective vanishing point of their parallel or nearly parallel courses appearing to an observer on the earth as it approaches them. The uniformity of position of these radiant points, the many corroborative observations on the direction, the distances, and the velocities of these bodies, the circumstance that their paths intersect the earth's orbit at certain definite periods, and the total failure of all other theories which have been advanced, while there is no substantial objection to this, afford evidence almost amounting to proof that these are cosmical bodies moving in the interplanetary space by gravitation round the sun, and some, perhaps, round planets. This view gives us a new element of continuity. The universe would thus appear not to have the extent of empty space formerly attributed to it, but to be studded between the larger and more visible masses with smaller planets, if the term may be applied to meteorites.

The number of known asteroids, or bodies of a smaller size than what are termed the ancient planets, has been so increased by numerous discoveries, that instead of seven we now count eighty-eight as the number of recognized planets. If we add these, the smallest of which is only three or four miles in diameter—indeed cannot be accurately measured—and if we were to apply the same scrutiny to other parts of the heavens as has been applied to the zone between Mars and Jupiter, it is no far-fetched speculation to suppose that between these asteroids and the meteorites, bodies of intermediate size exist until the space occupied by our solar system becomes filled up with planetary bodies, varying in size from that of Jupiter (1,240 times larger in volume than the earth) to that of a cannon-ball or even a pistol-bullet.

The researches of Leverrier on the intra-mercurial planets come in aid of these views, and another half century may, and not improbably will, enable us to ascertain that the now seemingly-vacant interplanetary spaces are occupied by smaller bodies which have hitherto escaped observation. But the evidence of continuity as pervading the universe does not stop at telescopic observation; chemistry and physical optics bring us new proofs. Those meteoric bodies which have from time to time come so far within reach of the earth's attraction as to fall upon its surface, give on analysis metals and oxides similar to those which belong to the structure of the earth—they come as travellers bringing specimens of minerals from extra-terrestrial regions.

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While chemistry thus aids us in ascertaining the relationship of our planet to meteorites, its relation in composition to other planets, to the sun, and to more distant suns and systems is aided by another science—optics.

I need not detail to you the discoveries of Kirchhoff, Bunsen, Miller, Huggins, and others, they have been dilated on by my predecessor. Assuming that spectrum analysis is a reliable indication of the presence of given substances by the position of transverse bright lines exhibited when they are burnt and of transverse dark lines when light is transmitted through their vapours, though Plücker has shown that with some substances these lines vary with temperature, the point of importance in the view I am presenting to you is, that while what may be called comparatively neighbouring cosmical bodies exhibit lines identical with many of those shown by the components of this planet, as we proceed to the more distant appearances of the nebulæ we get but one or two of such lines, and we get one or two new bands not yet identified with any known to be produced by substances on this globe.

Within the last year Mr. Huggins has added to his former researches observations on the spectrum of a comet (comet 1 of 1866), the nucleus of which shows but one bright line, while the spectrum formed by the light of the coma is continuous, seeming to show that the

nucleus is gaseous while the coma would consist of matter in a state of minute division shining by reflected light: whether this be solid, liquid, or gaseous is doubtful, but the author thinks it is in a condition analogous to that of fog or cloud. The position in the spectrum of the bright line furnished by the nucleus is the same as that of nitrogen, which also is shown in some of the nebulæ.

But the most remarkable achievement by spectrum analysis is the record of observations on a temporary star which has shone forth this year in the constellation of the northern crown about a degree S.E. of the star ε. When it was first seen, May 12th, it was nearly equal in brilliancy to a star of the second magnitude; when observed by Mr. Huggins and Dr. Miller, May 16th, it was reduced to the third or fourth magnitude. Examined by these observers with the spectroscope, it gave a spectrum which they state was unlike that of any celestial body they had examined.

There is strong reason to believe that this star is one previously seen by Argelander and Sir J. Herschel, and that it is a variable star of long or irregular period; it is also notable that some of its spectrum lines correspond with those of several variable stars.

It would seem as if the phenomenon of gradual change obtained towards the remotest objects with which we are at present acquainted, and that the further we penetrate into space the more unlike to those we are acquainted with become the objects of our examination—sun, planets, meteorites, earth similarly though not identically constituted, stars differing from each other and from our system, and nebulæ more remote in space and differing more in their characters and constitution.

While we thus can to some extent investigate the physical constitution of the most remote visible substances, may we not hope that some further insight as to the constitution of the nearest, viz., our own satellite, may be given us by this class of researches? The question whether the moon possesses any atmosphere may still be regarded as unsolved. If there be any, it must be exceedingly small in quantity and highly attenuated. Supposing the moon to be constituted of similar materials to the earth, it must be, to say the least, doubtful whether there is oxygen enough to oxidate the metals of which she is composed; and if not, the surface which we see must be metallic, or nearly so. The appearance of her craters is not unlike that seen on the surface of some metals, such as bismuth, or, according to Professor Phillips, silver, when cooling from fusion and just previous to solidifying; and it might be a fair subject of inquiry whether, if there be any coating of oxide on the surface, it may not be so thin as not to disguise the form of the congealed metallic masses, as they may have set in cooling from igneous fusion.

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After touching upon some other points of lunar physics, the President said:—

Before quitting the subject of astronomy I cannot avoid expressing a feeling of disappointment that the achromatic telescope, which has rendered such notable service to this science, still retains in practice the great defect which was known a century ago at the time of Hall and Dollond, namely, the inaccuracy of definition arising from what was termed the irrationality of the spectrum, or the incommensurate divisions of the spectra formed by flint and crown glass; and, notwithstanding the greatly improved manufacture, the defect to which I have adverted remains unremedied.

We have now a large variety of different kinds of glass formed from different metallic oxides. A list of many such was given by M. Jacquelain a few years back; the last specimen which I have seen is a heavy highly refracting glass formed from the metal thallium by M. Lamy. Among all these could no two or three be selected which, having appropriate refracting and dispersing powers, would have the coloured spaces of their respective spectra, if not absolutely in the same proportions, at all events much more nearly so than those of flint and crown glass? Could not, again, oily or resinous substances having much action on the green or middle colour of the spectrum, such as castor oil, canada balsam, &c., be made use of in combination with glass lenses to reduce if not annihilate this signal defect? This is not a problem to the solution of which there seems any insuperable difficulty; it is worth labouring for, as, could the defect be remedied, the refracting telescope would make nearly as great an advance upon its present state as the achromatic did on the single-lens refractor.

While gravitation, physical constitution, and chemical analysis by the spectrum show us that matter has similar characteristics in other worlds than our own, when we pass to the consideration of those other attributes of matter which were at one time supposed to be peculiar kinds of matter itself, or, as they were called, imponderables, but which are now generally, if not universally, recognised as forces or modes of motion, we find the evidence of continuity still stronger.

When all that was known of magnetism was that a piece of steel rubbed against a particular mineral had the power of attracting iron, and, if freely suspended, of arranging itself nearly in a line with the earth's meridian, it seemed an exceptional phenomenon. When it was observed that amber, if rubbed, had the temporary power of attracting light bodies, this also seemed something peculiar and anomalous. What are now magnetism and electricity? forces so universal, so apparently connected with matter as to become two of its invariable attributes, and that to speak of matter not being capable of being affected by these forces would seem almost as extravagant as to speak of matter not being affected by gravitation. So with light, heat, and chemical affinity, not merely is every form of matter with which we are acquainted capable of manifesting all these modes of force, but so-called matter supposed incapable of such manifestations would to most minds cease to be matter.

Further than this it seems to me (though, as I have taken an active part for many years, now dating from a quarter of a century, in promoting this view, I may not be considered an impartial judge) that it is now proved that all these forces are so invariably connected *inter se* and with motion as to be regarded as modifications of each other, and as resolving themselves objectively into motion, and subjectively into that something which produces or resists motion, and which we call force.

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It would be out of place here to trace how, by the labours of Oersted, Seebeck, Faraday, Talbot, Daguerre, and others, the way has been prepared for the generalization now known as the correlation of forces or conservation of energy, while Davy, Rumford, Seguin, Mayer, Joule, Helmholtz, Thomson, and others (among whom I would not name myself, were it not that I may be misunderstood and supposed to have abandoned all claim to a share in the initiation of this, as I believe, important generalization) have carried on the work; and how, sometimes by independent, and, as is commonly the case, nearly simultaneous deductions, sometimes by progressive and accumulated discoveries, the doctrine of the reciprocal interaction, of the quantitative relation, and of the necessary dependence of all the forces has, I think I may venture to say, been established.

If magnetism be, as it is proved to be, connected with the other forces or affections of matter, if electrical currents always produce, as they are proved to do, lines of magnetic force at right angles to their lines of action, magnetism must be cosmical, for where there is heat and light, there is electricity and consequently magnetism. Magnetism, then, must be cosmical and not merely terrestrial. Could we trace magnetism in other planets and suns as a force manifested in axial or meridional lines, *i.e.*, in lines cutting at right angles the curves formed by their rotation round an axis, it would be a great step; but it is one hitherto unaccomplished.

One of the most startling suggestions as to the consequence resulting from the dynamical theory of heat is that made by Mayer, that by the loss of *vis viva* occasioned by friction of the tidal waves, as well as by their forming, as it were, a drag upon the earth's rotatory movement, the velocity of the earth's rotation must be gradually diminishing, and that thus, unless some undiscovered compensatory action exist, this rotation must ultimately cease, and changes hardly calculable take place in the polar system.

M. Delaunay considers that part of the acceleration of the moon's mean motion which is not at present accounted for by planetary disturbances, to be due to the gradual retardation of the earth's rotation; to which view, after an elaborate investigation, the Astronomer Royal has given his assent.

Another most interesting speculation of Mayer is that the heat of the sun is occasioned by friction or percussion of meteorites falling upon it: there are some difficulties, not perhaps insuperable, in this theory. Supposing such cosmical bodies to exist in sufficient numbers they would, as they revolve round the sun, fall into it, not as an aërolite falls upon the earth directly by an intersection of orbits, but by the gradual reduction in size of the orbits, occasioned by a resisting medium; some portion of force would be lost, and heat generated in space by friction against such medium; when they arrive at the sun they would, assuming them, like the planets, to have revolved in the same direction, all impinge in a definite direction, and we might except to see some symptoms of such in the sun's photosphere; but though this is in a constant state of motion, and the direction of these movements has been carefully investigated by Mr. Carrington and others, no such general direction is detected; and M. Faye, who some time ago wrote a paper pointing out many objections to the theory of solar heat being produced by the fall of meteoric bodies into the sun, has recently investigated the proper motions of sun-spots, and believes he has removed certain apparent anomalies and reduced their motions to a certain regularity in the motion of the photosphere, attributable to some general action arising from the internal mass of the sun.

Assuming the undulatory theory of light to be true, and that the motion which constitutes light is transmitted across the interplanetary spaces by a highly elastic ether, then, unless this motion is confined to one direction, unless there be no interference, unless there be no viscosity, as it is now termed, in the medium, and consequently no friction, light must lose something in its progress from distant luminous bodies, that is to say, must lose something as light; for, as all reflecting minds are now convinced that force cannot be annihilated, the force is not lost, but its mode of action is changed. If light, then, is lost as light (and the observations of Struvé seem to show this to be so, that, in fact, a star may be so far distant that it can never be seen in consequence of its luminous emissions becoming extinct), what becomes of the transmitted force lost as light, but existing in some other form? So with heat; our sun, our earth, and planets are constantly radiating heat into space, so in all probability are the other suns, the stars, and their attendant planets. What becomes of the heat thus radiated into space? If the universe have no limit, and it is difficult to conceive one, there is a constant evolution of heat and light; and yet more is given off than is received by each cosmical body, for otherwise night would be as light and as warm as day. What becomes of the enormous force thus apparently nonrecurrent in the same form? Does it return as palpable motion? Does it move or contribute to move suns and planets? and can it be conceived as a force similar to that which Newton speculated on as universally repulsive and capable of being substituted for universal attraction? We are in no position at present to answer such questions as these; but I know of no problem in celestial dynamics more deeply interesting than this, and we may be no further removed from its solution than the predecessors of Newton were from the simple dynamical relation of matter to matter which that potent intellect detected and demonstrated.

Passing from extra terrestrial theories to the narrower field of molecular physics, we find the doctrine of correlation of forces steadily making its way.

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In a practical point of view the power of converting one mode of force into another is of the highest importance, and with reference to a subject which at present, somewhat prematurely perhaps, occupies men's minds, viz., the prospective exhaustion of our coal-fields, there is every encouragement derivable from the knowledge that we can at will produce heat by the expenditure of other forces; but, more than that, we may probably be enabled to absorb or store up as it were diffused energy —for instance, Berthelot has found that the potential energy of formate of potash is much greater than that of its proximate constituents, caustic potash and carbonic oxide. This change may take place spontaneously and at ordinary temperatures, and by such change carbonic oxide becomes, so to speak, reinvested with the amount of potential energy which its carbon possessed before uniting with oxygen, or, in other words, the carbonic oxide is raised as a force-possessor to the place of carbon by the direct absorption or conversion of heat from surrounding matter.

Here we have as to force-absorption, an analogous result to that of the formation of coal from carbonic acid and water; and though this is a mere illustration, and may never become economical on a large scale, still it and similar examples may calm apprehension as to future means of supplying heat, should our present fuel become exhausted. As the sun's force, spent in times long past, is now returned to us from the coal which was formed by that light and heat, so the sun's rays, which are daily wasted, as far as we are concerned, on the sandy deserts of Africa, may hereafter, by chemical or mechanical means, be made to light and warm the inhabitants of the denizens of colder regions. The tidal wave is, again, a large reservoir of force hitherto almost unused.

The valuable researches of Prof. Tyndall on radiant heat afford many instances of the power of localizing, if the term be permitted, heat which would otherwise be dissipated.

The discoveries of Graham, by which atmospheric air, drawn through films of caoutchouc, leaves behind half its nitrogen, or, in other words, becomes richer by half in oxygen, and hence has a much increased potential energy, not only show a most remarkable instance of physical molecular action, merging into chemical, but afford us indications of means of storing up force, much of the force used in working the aspirator being capable at any period, however remote, of being evolved by burning the oxygen with a combustible.

What changes may take place in our modes of applying force before the coal-fields are exhausted it is impossible to predict. Even guesses at the probable period of their exhaustion are uncertain. There is a tendency to substitute for smelting in metallurgic processes, liquid chemical action, which of course has the effect of saving fuel; and the waste of fuel in ordinary operations is enormous, and can be much economised by already known processes. It is true that we are, at present, far from seeing a practical mode of replacing that granary of force the coal-fields; but we may with confidence rely on invention being in this case, as in others, born of necessity, when the necessity arises.

Two very remarkable applications of the convertibility of force have been recently attained by the experiments of Mr. Wilde and Mr. Holz; the former finds that, by conveying electricity from the coils of a magneto-electric machine to an electro-magnet, a considerable increase of electrical power may be attained, and by applying this

as a magneto-electric machine to a second, and in turn to a third electro-magnetic apparatus, the force is largely augmented. Of course, to produce this increase, more mechanical force must be used at each step to work the magneto-electric machines; but provided this be supplied there hardly seems a limit to the extent to which mechanical may be converted into electrical force.

Mr. Holz has contrived a Franklinic electrical machine, in which a similar principle is manifested. A varnished glass plate is made to revolve in close proximity to another plate having two or more pieces of card attached, which are electrified by a bit of rubbed glass or ebonite; the moment this is effected a resistance is felt by the operator who turns the handle of the machine, and the slight temporary electrization of the card converts into a continuous flood of intense electricity the force supplied by the arm of the operator.

These results offer great promise of extended application; they show that, by a mere formal disposition of matter, one force can be converted into another, and that not to the limited extent hitherto attained, but to an extent co-ordinate, or nearly so, with the increased initial force.

In physiology very considerable strides are being made by studying the relation of organised bodies to external forces; and this branch of inquiry has been promoted by the labours of Carpenter, Bence Jones, Playfair, E. Smith, Frankland, and others.

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These and many similar classes of research show that in chemical inquiries, as in other branches of science, we are gradually relieving ourselves of hypothetical existences. As phlogiston and similar creations of the mind have passed away, so with hypothetic fluids, imponderable matters, specific ethers, and other inventions of entities made to vary according to the requirements of the theorist, I believe the day is approaching when these will be dispensed with, and when the two fundamental conceptions of matter and motion will be found sufficient to explain physical phenomena.

The facts made known to us by geological inquiries, while on the one hand they afford striking evidence of continuity, on the other, by the breaks in the record, may be used as arguments against it. The great question once was, whether these chasms represent sudden changes in the formation of the earth's crust, or whether they arise from dislocations occasioned since the original deposition of strata, or from gradual shifting of the areas of submergence. Few geologists of the present day would, I imagine, not adopt the latter alternative.

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When we compare with the old theories of the earth, by which the apparent changes on its surface were accounted for by convulsions and cataclysms, the modern view inaugurated by Lyell, your former President, and now, if not wholly, at all events to a great extent adopted, it seems strange that the referring past changes to similar causes to those which are now in operation should have remained uninvestigated until the present century; but with this, as with other branches of knowledge, the most simple is frequently the latest view which occurs to the mind. It is much more easy to invent a *Deus ex machinâ* than to trace out the influence of slow continuous change; the love of the marvellous is so much more attractive than the patient investigation of truth, that we find it to have prevailed almost universally in the early stages of science.

In astronomy we had crystal spheres, cycles, and epicycles; in chemistry, the philosopher's stone, the elixir vitæ, the archæus or stomach demon, and phlogiston; in electricity, the notion that amber possessed a soul, and that a mysterious fluid could knock down a steeple. In geology, a deluge or volcano was supplied. In palæontology a new race was created whenever theory required it; how such new races began, the theorist did not stop to inquire.

A curious speculator might say to a palæontologist of even recent date, in words freely paraphrased from Lucretius:—" You have abandoned the belief in one primæval creation at one point of time, you cannot assert that an elephant existed when the first saurians roamed over earth and water. Without, then, in any way limiting Almighty power, if an elephant were created without progenitors, the first elephant must, in some way or other, have physically arrived on this earth. Whence did he come? did he fall from the sky (*i.e.*, from the interplanetary space)? did he rise moulded out of a mass of amorphous earth or rock? did he appear out of the cleft of a tree? If he had no antecedent progenitors, some such beginning must be assigned to him." I know of no scientific writer who has, since the discoveries of geology have become familiar, ventured to present, in intelligent terms, any definite notion of how such an event could have occurred; those who do not adopt some view of continuity are content to say God willed it; but would it not be more reverent and more philosophical to inquire by observation and experiment, and to reason from induction and analogy, as to the probabilities of such frequent miraculous interventions?

I know I am touching on delicate ground, and that a long time may elapse before that calm inquiry after truth, which it is the object of associations like this to promote, can be fully attained; but I trust that the members of this body are sufficiently free from prejudice, whatever their opinions may be, to admit an inquiry into the general question whether what we term species are and have been rigidly limited, and have at numerous periods been created complete and unchangeable, or whether, in some mode or other, they have not gradually and indefinitely varied, and whether the changes due to the influence of surrounding circumstances, to efforts to accommodate themselves to surrounding changes, to what is called natural selection, or to the necessity of yielding to superior force in the struggle for existence, as maintained by our illustrious countryman Darwin, have not so modified organisms as to enable them to exist under changed conditions.

The President then discussed at some length the main arguments for and against continuity as applied to the history of organic beings.

As we detect no such phenomenon as the creation or spontaneous generation of vegetables and animals, which are large enough for the eye to see without instrumental assistance, the field of this class of research has become identified with the field of the microscope, and at each new phase the investigation has passed from a larger to a smaller class of organisms. The question whether among the smallest and apparently the most elementary forms of organic life the phenomenon of spontaneous generation obtains, has recently formed the subject of careful experiment and animated discussion in France. Although we see no such phenomenon as the formation of an animal such as an elephant, or a tree such as an oak, excepting from a parent which resembles it, yet if the microscope revealed to us organisms, smaller but equally complex, so formed without having been reproduced, it would render it not improbable that such might have been the case with larger organic beings. The controversy between M. Pasteur and M. Pouchet has led to a very close investigation of this subject, and the general opinion is that when such precautions are taken as exclude from the substance submitted to experiment all possibility of germs from the atmosphere being introduced, as by passing the air which is to support the life of the animalculæ through tubes heated to redness and other precautions, no formation of organisms takes place. Some experiments of Mr. Child's, communicated to the Royal Society during the last year, again throw doubt on the negative results obtained by M. Pasteur; so that the question may be not finally determined, but the balance of experiment and opinion is against spontaneous generation.

Actual experiment, however, seems to have done little to elucidate the question, nor, unless we can suppose the experiments continued through countless generations, is it likely to contribute much to its solution. We must therefore have recourse to the enlarged experience or induction from the facts of geology, palæontology, and physiology, aided by analogy from the laws of action which nature evidences in other departments.

The President then gave an outline of the arguments on this subject, deducible from the present state of these sciences, and concluded as follows:—

The recent discoveries in palæontology show us that man existed on this planet at an epoch far anterior to that commonly assigned to him. The instruments connected with human remains, and indisputably the work of human hands, show that to these remote periods the term civilisation could hardly be applied—chipped flints of the rudest construction, probably in the earlier cases fabricated by holding an amorphous flint in the hand, and chipping off portions of it by striking it against a larger stone or rock; then, as time suggested improvements, it would be more carefully shaped, and another stone used as a tool; then (at what interval we can hardly guess) it would be ground, then roughly polished, and so on,—subsequently bronze weapons, and nearly the last before we come to historical periods, iron. Such an apparently simple invention as a wheel must, in all probability, have been far subsequent to the rude hunting tools or weapons of war to which I have alluded.

A little step-by-step reasoning will convince the unprejudiced that what we call civilisation must have been a gradual process. Can it be supposed that the inhabitants of Central America or of Egypt suddenly and what is called instinctively built their cities, carved and ornamented their monuments? If not, if they must have learned to construct such erections, did it not take time to acquire such learning, to invent tools as occasion required, contrivances to raise weights, rules or laws by which men acted in concert to effect the design? Did not all this require time? And if, as the evidence of historical times shows, invention marches with a geometrical progression, how slow must have been the earlier steps. If even now habit, and prejudice resulting therefrom, vested interests, &c., retard for some time the general application of a new invention, what must have been the degree of retardation among the comparatively uneducated beings which then existed?

If I appear to lean to the view that the successive changes in organic beings do not take place by sudden leaps, it is, I believe, from no want of an impartial feeling; but if the facts are stronger in favour of one theory than another, it would be an affectation of impartiality to make the balance appear equipoised.

The prejudices of education and associations with the past are against this as against all new views; and while on the one hand a theory is not to be accepted because it is new and *primâ facie* plausible, still to this assembly I need not say that its running counter to existing opinions is not necessarily a reason for its rejection; the *onus probandi* should rest on those who advance a new view, but the degree of proof must differ with the nature of the subject. The fair question is, Does the newly proposed view remove more difficulties, require fewer assumptions, and present more consistency with observed facts than that which it seeks to supersede? if so, the philosopher will adopt it, and the world will follow the philosopher—after many days.

It must be borne in mind that even if we are satisfied, from a persevering and impartial inquiry, that organic forms have varied indefinitely in time, the *causa causans* of these changes is not explained by our researches; if it be admitted that we find no evidence of amorphous matter suddenly changed into complex structure, still why matter should be endowed with the plasticity by which it slowly acquires modified structure is unexplained. If we assume that natural selection, or the struggle for existence, coupled with the tendency of like to reproduce like, gives rise to various organic changes, still our researches are at present uninstructive as to why like should produce like, why acquired characteristics in the parent should be reproduced in the offspring. Reproduction itself is still an enigma, and this great question may involve deeper thoughts than it would be suitable to enter upon now.

Perhaps the most convincing argument in favour of continuity which could be presented to a doubting mind would be the difficulty it would feel in representing to itself any *per saltum* act of nature. Who would not be astonished at beholding an oak tree spring up in a day, and not from seed or shoot? We are forced by experience, though often unconsciously, to believe in continuity as to all effects now taking place; if any one of them be anomalous we endeavour, by tracing its history and concomitant circumstances, to find its cause, *i.e.*, to relate it to antecedent phenomena; are we then to reject similar inquiries as to the past? is it laudable to seek an explanation of present changes by observation, experiment, and analogy, and yet reprehensible to apply the same mode of investigation to the past history of the earth and of the organic remains embalmed in it?

If it be true that continuity pervades all physical phenomena, the doctrine applied by Cuvier to the relations of the different parts of an animal to each other might be capable of great extension. All the phenomena of inorganic and organized matter might be expected to be so inter-related that the study of an isolated phenomenon would lead to a knowledge of numerous other phenomena with which it is connected. As the antiquary deduces from a monolith the tools, the arts, the habits, and epoch of those by whom it is wrought, so the student of science may deduce from a spark of electricity or a ray of light the source whence it is generated; and by similar processes of reasoning other phenomena hitherto unknown may be deduced from their probable relation with the known. But, as with heat, light, magnetism, and electricity, though we may study the phenomena to which these names have been given, and their mutual relations, we know nothing of what they are; so, whether we adopt the view of natural selection, of effort, of plasticity, &c., we know not why organisms should have this *nisus formativus*, or why the acquired habit or exceptional quality of the individual should reappear in the offspring.

But the doctrine of continuity is not solely applicable to physical inquiries. The same modes of thought which lead us to see continuity in the field of the microscope as in the universe, in infinity downwards as in infinity upwards, will lead us to see it in the history of our own race; the revolutionary ideas of the so-called natural rights of man, and *à priori* reasoning from what are termed first principles, are far more unsound and give us far less ground for improvement of the race than the study of the gradual progressive changes arising from changed circumstances, changed wants, changed habits. Our language, our social institutions, our laws, the constitution of which we are proud, are the growth of time, the product of slow adaptations, resulting from continuous struggles. Happily in this country, though our philosophical writers do not always recognize it, practical experience has taught us to improve rather than to remodel; we follow the law of nature and avoid cataclysms.

The superiority of man over other animals inhabiting this planet, of civilised over savage man, and of the more civilised over the less civilised, is proportioned to the extent which his thought can grasp of the past and of the future. His memory reaches further back, his capability of prediction reaches further forward in proportion as his knowledge increases. He has not only personal memory which bring to his mind at will the events of his individual life. He has history, the memory

of the race; he has geology, the history of the planet; he has astronomy, the geology of other worlds. Whence does the conviction to which I have alluded, that each material form bears in itself the records of its past history, arise? Is it not from the belief in continuity? Does not the worn hollow on the rock record the action of the tide, its stratified layers the slow deposition by which it was formed, the organic remains embedded in it the beings living at the times these layers were deposited, so that from a fragment of stone we can get the history of a period myriads of years ago? From a fragment of bronze we may get the history of our race at a period antecedent to tradition. As science advances our power of reading this history improves and is extended. Saturn's ring may help us to a knowledge of how our solar system developed itself, for it as surely contains that history as the rock contains the record of its own formation.

By this patient investigation how much have we already learned, which the most civilised of ancient human races ignored! While in ethics, in politics, in poetry, in sculpture, in painting, we have scarcely, if at all, advanced beyond the highest intellects of ancient Greece or Italy, how great are the steps we have made in physical science and its applications.

But how much more may we not expect to know? We, this evening assembled, ephemera as we are, have learned by transmitted labour to weigh, as in a balance, other worlds larger and heavier than our own, to know the length of their days and years, to measure their enormous distance from us and from each other, to detect and accurately ascertain the influence they have on the movements of our world and on each other, and to discover the substances of which they are composed; may we not fairly hope that similar methods of research to those which have taught us so much may give our race further information, until problems relating not only to remote worlds, but possibly to organic and sentient beings which may inhabit them, problems which it might now seem wildly visionary to enunciate, may be solved by progressive improvements in the modes of applying observation and experiment, induction and deduction.

SPECIAL MIDDLE-CLASS EDUCATION IN FRANCE.

The Minister of Public Instruction and other authorities in France are using all their endeavours at the present moment to afford means of sound special education to the youth of the middle-classes. The thorough education of the industrial, commercial, and agricultural classes is an object upon which no amount of real study and time can be misapplied; it is the cultivation of the very heart of a nation. Besides its general importance, it has a special meaning in France, where the system of gratuitous or semi-gratuitous education of the first-class has rendered the aspirants for the liberal professions and sciences so unusually numerous, in fact, so out of proportion to other matters. The object of the improvements now being carried out, or which are under consideration, is to develope all the intellectual faculties, to give to the manual employments their due importance, and to arrest the undue tendency referred to above; in short, to counterbalance the effect of vanity, which pushes so many young men towards the so-called liberal professions, in which so few succeed, by pointing out the value of other occupations, and showing how they may raise both themselves and their professions by the careful study of the principles which underlie them, and of the practices by which they are carried out. In the secondary special schools, geometry, commercial geography, the applied sciences, French literature, foreign languages, and not classics, will form the main objects of study, while Latin will merely have place as an auxiliary. Those pupils who exhibit not only a desire but a real aptitude for higher, or what are commonly regarded as higher, studies, may be transferred to the other schools or colleges, but the main object in view is to give something more than average education to average talents.

Special model schools are to be established in several parts of the country to serve at once as nurseries and types with the best possible teachers, collections of instruments of precision, laboratories and extensive libraries. One of these special schools or colleges will be attached to the new normal school for special education, which has been more than once referred to in this *Journal*, and which is to open its doors in October in the present year. In addition to this the east of France will have another college of the same class—the professional school of Mulhouse—which is about to be remodelled on the plan laid down in the new scheme of secondary special education.

At the other extremity of France, at Mont de Marsan, a new *lycée*, which also opens in October, is to become the model school for special instruction in the south-western districts; and it is said that the maire of a manufacturing town in the neighbourhood of the Rhone has subscribed, anonymously, the sum of 15,000 francs for the transformation of a classical college into a special school of instruction.

The principles which will regulate these and other schools of the same class to be established will of course be common to all, but their application will not be uniform, the courses of study being modified according to the nature of the industry of the neighbourhood; thus, while in one district the new school will become a secondary school of mines, in another it will be principally an agricultural, and in a third chiefly a manufacturing college; though in all probability the special studies will be mixed, only one element will generally predominate in each.

The too great pressure of young men towards the liberal professions is easily accounted for in France, not only by the facilities offered by the government, but also by the comparatively small importance formerly attached by the educated portion of the French people to industrial pursuits; but the great progress which has been made of late years in manufacturing and commercial matters has not only created a necessity for superior special education, but has raised material employments greatly in the opinion of the public.

But in spite of the greater popularity of the liberal professions and fine arts above alluded to, it should not be unknown or forgotten by those who are aware of the fact, that the old special schools and colleges of France have done much for sound scientific training, and that no country possesses a higher educated class of mining engineers, manufacturers, chemists, and others. The Polytechnic School and the School of Mines have furnished hundreds of brilliant examples of men who combine classical acquirements with sound scientific knowledge and accomplished manners; and if the new schools should do as much in proportion for the classes possessing smaller means, we may see in a few years much of the redundancy of the ranks of art spread over and fertilizing the more directly necessary and equally honourable fields of agriculture and industry.

Movements such as these may well excite other nations to emulation, and they deserve and obtain the admiration of all well-toned minds, while, if any feel a spark of envy, they must be assured that the only means of competition are to be found in adopting similar principles modified in their application according to the occupations and the circumstances of each country, and the peculiar characteristics of its people. We have done a good deal of late for ourselves in the way of middle-class and special education, but it would be folly to shut our eyes and ears to the evidence which proves how much more remains yet to be done.

Fine Arts.

ARCHITECTURAL COMPETITION.—The authorities of the busy little town of Charleroi, in Belgium, invite foreign as well as Belgian architects to submit plans for the enlargement of the town, the demolition of its fortifications, and the reconstruction of its railway station. The first prize is of the value of £200, but it is not stated whether the recipient will be entrusted to carry out his design; the next best design to be rewarded with the sum of £80. The prize plans to remain the property of the municipality, which, moreover, reserves to itself the right of purchasing any of the others for the sum of £20.

LOCAL FINE ART EXHIBITIONS IN FRANCE.—The number and importance of provincial exhibitions increase every day. That of Lille is now open, and contains more than fifteen hundred works, of which twelve hundred are oil paintings. Orleans has just had its first exhibition, and the result must be considered as highly encouraging for artists; out of about one hundred and fifty works sent from Paris for Exhibition twenty-five were sold, all but three being oil paintings. The Rouen exhibition, one of the most important of all the provincial exhibitions, is announced to open on the 25th of September. The list of prizes includes a gold medal of the value of £40, and four small gold medals, and the municipal authorities, the Society of the Friends of Art, and many private individuals buy largely. The exhibition remains open for two months. An exhibition is now open at Grenoble, the first that has been held in that town for nine years, and includes four or five hundred works of art.

STATUES IN COPPER REPOUSSE.—The execution of statues in beaten copper, like that exhibited outside the central door of the Universal Exhibition of 1862, in the Cromwell-road, and the admirable colossal statue of Vercingétorix, by M. Aimé Millet, set up in the native town of the famous Gallic chieftain, seems likely to obtain the extension it deserves; the municipal council of Marseilles has opened a competition for a statue of the Virgin, to be executed in this manner, for the new church of Notre Dame de la Garde. Three eminent sculptors have signified their intention of competing. For heroic and colossal statues and groups, and, consequently, for public monuments to be erected out of doors, this mode of execution is admirably adapted, as enabling the artist to produce great boldness with a very small amount of metal, and with little weight, and it is difficult to conceive a more imposing memorial than a statue, with a hill for its basis, which may be seen for miles around. Colossal modelling has, moreover, this advantage, that it demands the greatest possible attention, not only to proportion, but also to effects, and thus leads to a bold, broad style, that is equally important, not only as regards single statues and groups, but in architectural works.

Manufactures.

STEAM-BOILERS.—The Engineer to the Manchester Association, in his report for July, draws special attention to some of the defects and imperfections that have been discovered in the examination of various boilers under inspection by the Association:—With regard to internal corrosion, some corrosive waters not only waste and indent the surface of boilers internally, but also destroy the vitality of the metal, so that the edge of the overlap may be cut away with a few slight blows with the hammer, and the rivet heads knocked off with a hand chisel only, and easily pulverised. Such was the character of the defects found in one of the boilers examined during the past month, and which was at once laid off by the owners, and condemned as soon as its condition was pointed out. The above shows the importance of carefully testing corroded rivet heads with a hammer. With regard to external corrosion, two dangerous cases arose from leakage at the joints of boiler mountings, in consequence of their being bolted to the shell instead of rivetted. The plates were so eaten away that in one case the inspector scraped a hole through with his chisel, while this could easily have been repeated in the other. One of the mountings was a cast-iron manhole mouthpiece of somewhat large size, and as the corrosion extended in a groove all round it the boiler was clearly unsafe to be worked, and was immediately laid off. This encircling groove was not very easy of detection, since, although nearly eating through the plate, it was only three-eighths to half an inch wide, and almost buried under the edge of the casting; added to which it was filled up with tar with which the boiler had been coated. All mountings, instead of being bolted to boilers, should be attached with suitable fitting blocks rivetted to the shell. In reference to deficiency of water, this arose at night-time, when the fires were banked up, from the attendant's omitting to close the feed-stop valve, there being no self-acting back-pressure valve, and the feed inlet being below the furnace crowns. The importance of every boiler being fitted with a good self-acting feed back-pressure valve, as well as of the feed inlet being above the level of the furnace crowns, has been frequently pointed out in previous reports. The furnace crown was fitted with one of those fusible plugs in which the alloy is in the shape of a washer about the size of a pennypiece, having a copper button in the centre of it. This did not, however, prevent the plates becoming red hot. The plug did not put out the fire, or, properly speaking, go off at all. A little piece of the alloy melted away on one side and allowed a slight escape of steam, which fortunately attracted the attention of a workman, who at once examined the boiler and found the furnace crown red hot.

Commerce.

A NEW INDUSTRY FOR IRELAND.—The following is from *The Grocer*:—Beet sugar, which would in Ireland yield a larger return to the grower than flax, is the new branch of industry to which we desire to draw attention. We are prompted in that desire by two circumstances—one, the publication a few months since of a very able pamphlet by Mr. A. Baruchson, of Liverpool, upon the "History and Progress of the Manufacture of Beetroot Sugar;" and the other the recent completion of a very extensive sugar refinery in Dublin, the first and only refinery that Ireland can boast of. The Messrs. Bewley and Company have not only set an example which should stimulate their countrymen to enterprise, both in this and other branches of trade, but have partially provided the very means by which a crop of beetroot, easily cultivated, may be rendered extremely profitable to speculators. It is even stated that a beet crop in Ireland would yield on the average nearly half as much more per acre as in France, the soil and climate being more favourable for the growth of beet, while improvements in agriculture, united to British capital, would increase the production still more.

BEET SUGAR IN THE UNITED STATES.—We learn from New Orleans (say Messrs. Travers) that the first load of seeds of white Silesian beetroot, amounting to about six tons, has just been imported into America from France, with a view to its being sown in Illinois; and from the crop which is to be raised from this seed it is expected sugar will be made during the present year. The consequences of this movement it is impossible to foresee, but there can be no doubt that, if it be successful, it will greatly affect the cultivation of the cane sugar in Louisiana. The introduction of the beet into the United States is naturally looked upon with uneasiness by the planters in Louisiana, who will doubtless take steps to resist the inroad likely to be made upon their

special branch of cultivation by this formidable rival· "In view of the efforts made," says the *Renaissance Louisianaise,* "to deprive Louisiana of its sugar market, it is high time that our sugar manufacturers should take into consideration the whole question of the sugar industry, and oppose an organized resistance to the new movement." In the present age of free-trade, the best, and indeed the only permanent way of successfully combating with the beet sugar, is—not by any protective system—but by improving the quality of the cane sugar, and by the judicious employment of all the most recent inventions to bring the cost of manufacture down to the lowest point consistent with a fair return for labour and capital. At the same time it by no means follows that the success of the beetroot implies the relinquishment of the cane sugar cultivation, or *vice versâ;* with the increasing populations and increasing demand there is ample room, we contend, for the development of both, and we await with interest the renewed efforts that will doubtless be made by the advocates of both, and the ultimate effects of these efforts on the condition and prospects of the American sugar trade.

Sherry Wine.—A very large portion of the wine exported from Cadiz is sent to London and other ports in Britain. This is far the largest shipment. The other destinations coming next in importance are New York, Russia, and Hamburg. Various grades of sherry are shipped at prices ranging from £10 to £200 sterling per butt, and these wines may be enumerated under four classes, viz:—1. Low and spurious compounds, at from £10 to £20 per butt (say) one-fifth of the whole. 2. Common, ordinary, and middling sherry, from £25 to £45 per butt (say) two-fifths. 3. Good sherry, from £45 to £70 per butt (say) three-tenths. 4. Superior sherry, from £70 to £200 per butt, one-tenth. The wine district between Port St. Mary's and Jères yields the better growths; and the low qualities are made up of Seville, Cordova, Moguèr, Lebrija, Tribujena, Chiclana, Chipiona, and San-Lucar wines, which are brought down to the two shipping towns, and made up under the general denomination of "sherry." During the past year large quantities of wines have been introduced into the district from Malaga and Alicante; but these wines have not proved serviceable or usable, their peculiar earthy and tarry character it being impossible to overcome; as, though mixed with other wines, in but small quantities, the unpleasant flavour and smell is always distinguishable to a judge of wine. The low spurious compounds adverted to are made up with molasses, German potato spirit, and water, to which some colouring matter, and a small quantity of wine are added, much in the same manner that the "Hamburg sherries" have been manufactured, to which of late the London customhouse has, very properly, refused admittance. Of course, no known respectable wine merchant would lend himself to ship such low and adulterated compounds; but that it is done, and, moreover, with the cognizance of the consignees in London, is well known; because such wines are usually sold by auction on their arrival at extraordinarily low prices; which, unless the "liquid stuff" in question were wonderfully cheaply procured, would leave to the shippers a heavy loss.

The Spanish Shipping Interest.—It appears, by a recent consular report, that the number of Spanish ships which entered Spanish ports between the years 1850 and 1862 was 4,216; the quantity of merchandise, 226,224 tons; and the number of seamen employed, 59,969. The number of foreign ships during the same period was 4,199, with cargoes to the amount of 943,873, and employing 40,961 seamen. The number of Spanish ships which cleared was 3,466, cargoes, 209,915, seamen, 45,012; and the number of foreign ships, 3,216; cargoes, 529,014; seamen, 34,697. It results, therefore, that though there were 267 more Spanish than foreign ships, they carried 1,036,748 tons of merchandise less, and required 29,053 seamen more. The Spanish ships measured 934,724 tons, and carried only 436,139 tons of cargo, thus showing a loss of space of 53·34 per cent., while this loss in the foreign ships was 0·46 per cent. The average amount of cargo carried by each Spanish ship was 56·92 tons, while the foreign ships averaged 196·64. Each Spanish ship employed one man for every four tons; each foreign ship one man for every seventeen tons. Unless there is a change in the system, it is clear that ere long the Spanish mercantile marine will be forced to content itself with the coasting trade. In almost every other country the greatest pains are taken to build as cheaply, and at the same time as commodiously, as possible. But in Spain it is otherwise. Means are adopted to enhance the cost of ship-building, and maritime regulations increase the cost of navigation. To counterbalance this, then, the Government have adopted the differential duty, and such appears to be the attachment to this species of protection, that although the produce of the northern provinces is oftentimes sent to Bordeaux for shipment in French bottoms, on account of the high rate of Spanish freights, still the fact that the national shipping is only bolstered up in this manner in order to enable it just to hold its own against the foreign, seems not to be recognised. The very idea of the abolition of this duty is alarming to the shipping interest; for, relying on its privileges to maintain its superiority, it has made no exertion to improve its material, and foresees with dread, if they should be withdrawn, the successful competition of the foreigner. The same system which in former times ruined the internal commerce of the country, is still at work to ruin its external commerce.

Colonies.

Trade of New Zealand.—The total imports of the colony for the year 1865 were £5,587,683, against £6,997,357 for 1864. The exports for 1865 were £3,724,691 against £3,457,909, showing a decrease in the imports of £1,409,674, but an increase in the exports of £316,782. There has been a falling of in the imports, both on the quarter and the year, as compared with the previous year, while there has been an undeniable increase in the value of exports. The item of £1,419,674 on the year's trading of 1865 shows a very considerable fluctuation of trade, and this great reduction is but poorly compensated for by the increase of exports, seeing it is entirely made up of gold. The value of gold exports on the December quarter was £993,444, as against £361,977 in the same period of 1864. It appears that, with a much larger production of gold, no stimulus has been given to business; on the contrary, business, if measured by the imports, has been curtailed. But this is not any proof of going back, as it is a well-known fact that there was a great deal of over-trading and speculation in 1863-4, and stocks were wisely reduced in the past year. On the whole these returns are considered satisfactory.

Emigration.—It appears, by the report of the Emigration Commissioners, that in the 51 years that have elapsed since 1814 there have left the United Kingdom 5,901,501 emigrants, of whom 3,597,789, or nearly 61 per cent., have gone to the United States, 2,177,850 to British colonies, and 125,871 to other places. The emigration during the year 1865 was 209,801, of whom there were 61,345 English, 12,870 Scotch, and 100,676 Irish. In the first three months of the present year 39,672 persons left the United Kingdom, of whom 32,913 went to the United States.

The Alpaca and Llama.—It appears by a Sydney paper that the Government have determined to sell the flocks of alpacas and llamas, which cost several years ago £15,000. Last year the flock was considerably larger than it is at present. The animals have suffered much from drought. The flock now consists of about 190 alpacas, llamas, and hybrids, all of which were

represented to be in a strong and healthy condition. It was anticipated that some of the Colonial Governments would compete for the animals, or a part of them; the sale has, therefore, been fixed for a distant period.

Cochineal.—A Melbourne paper says:—Some cochineal insects with their larvæ have been received by Dr. Mueller from Sir George Grey, Governor of New Zealand, and it is intended to attempt their propagation here upon suitable cactus plants as an experiment.

Obituary.

Mr. Robert Temple, Master of the Supreme Court at Mauritius, died on Friday, the 6th July, after a short but painful illness, borne with the utmost fortitude and resignation. He was 65 years old at the time of his decease, and had held the above-named appointment at Mauritius three years and two months. He had been previously, and for 18 years, Chief-Justice of British Honduras, where he did much to call attention to and develop the industrial and commercial resources of the colony. He was elected a member of the Society of Arts in 1855, but even previously to that time, while in Honduras, forwarded numerous interesting and valuable contributions to the *Journal* upon the resources of that colony.* On his return to England he was a frequent visitor at the house of the Society, and evidently took much pleasure in attending its meetings. The paper read by him in January, 1857,† on the "History, Trade, and Natural Resources of Honduras," was especially able and exhaustive, and excited much attention among all interested in colonial questions. After leaving Honduras, and while in England, he acted as secretary to the Commission on Metalliferous Mines, appointed by the Government, and of which Lord Kinnaird was the Chairman. A Mauritius journal, after expressing regret for his loss, says that it would be generally "acknowledged that during his term of office nothing could exceed the patience and good humour of his demeanour, while all must be satisfied of the strict impartiality and perfect integrity which actuated him in the fulfilment of his official duties. In his private circle of relations and friends the late Robert Temple will be sadly missed and deservedly regretted. His temperament was a most joyous one; witty, full of anecdote, endowed with a world of general information, his conversation was listened to with admiring pleasure, while the suavity of his manners, and, above all, the frequent indications of the kind heart which beat in his breast, endeared him to every one who had the advantage of his acquaintance." These favourable sentiments will certainly be echoed by his numerous friends in England.

Notes.

Music.—The *Saturday Review* says:—"Music is one of the highest educational influences that a nation can undergo, and an influence, moreover, that probably no nation so much needs as our own."

The Education Committee.—The Select Committee appointed to inquire into the constitution of the Committee of Council on Education, and the system under which the business of the office is conducted, and also into the best mode of extending the benefits of Government inspection and the Parliamentary grants to schools at present unassisted by the state, have reported that, in consequence of the change of administration, they have not been able to ascertain the views of the present Government on the main points to be considered, and have therefore determined not to enter upon the discussion of the important draught report presented to them by their chairman; but have resolved to lay the evidence alone upon the table of the House, leaving it for the House to determine whether they shall be re-appointed next year, in order to prepare a report thereon. The report proposed by the chairman, Sir John Pakington, contained the following recommendations:—"1. That the Committee of Council on Education, as being no longer adapted to the purpose for which it was formed, should cease to exist. 2. That there should be a Minister of Public Instruction, with a seat in the Cabinet, who should be intrusted with the care and superintendence of all matters relating to the national encouragement of science and art and popular education in every part of the country. 3. That although they cannot endanger the supply of competent teachers by proposing abandonment of the teacher's certificate as a condition of assistance to the school, such a modification of that condition should be adopted as would prevent it from being, as it now is, an impediment to the extension of education. 4. The establishment of local organisation in connection with the Education Department, so as to put an end to the present injurious centralization, and enable the superintendence of education to be conducted in a manner similar to that in which the Poor-law is administered by Boards of Guardians under the guidance and control of the Poor-law Board. 5. That power should be given to levy a rate for the promotion of education in certain cases, to be defined. 6. That to meet the difficulty caused by the small area and population of many parishes, small schools should be combined under a good circulating master, or small parishes combined with a good central school, as the circumstances of the locality might render most expedient. 7. That the numerous educational endowments, now almost useless, should be reformed, and made available. 8. That the difficulty caused by religious difference should be met by the compulsory adoption of the 'Conscience Clause' in every trust deed, the Education Minister being empowered to suspend the annual grant to any school on proof of exclusion or undue constraint of Nonconformists on religious grounds. 9. That the impediments to education in Wales, arising from the state of religious opinion in that country, should be met by the adoption, in a liberal spirit, of some plan similar to those suggested in the evidence and in this report."

Instantaneous Photography by Artificial Light.—Some experiments have been recently made by Mr. Skaife in taking photographs by artificial light instantaneously. A plate, carefully prepared, is put into a camera; the sitter, in a partially dark room, engages in conversation with any one, so as to secure a natural play of expression; a little powder on the pan of a lamp of peculiar construction is set off in a puff, like the flash of a charge of gunpowder, and thus an instantaneous picture is taken. The powder is composed of certain parts of pulverised magnesium and chlorate of potash, and is set on fire by being heated by a spirit lamp under the pan, which has a hole in it, and the light is brought into contact with the dry powder when the pan is slightly shaken by means of a wire. The pan having a reflector at the back, the light is thrown full on the sitter, and the negative is said to be obtained in about the fiftieth part of a second.

Monte Cassino.—A parliamentary paper has been issued, containing correspondence with the Italian Government respecting the suppression of ecclesiastical corporations in Italy. The interest which the learned in this country have taken in the preservation of the great Benedictine house of Monte Cassino is well known. Addresses on the subject were forwarded to Her Majesty's Government from the President of the Society of Antiquaries and from the Archæological Institute of Great Britain and Ireland, appealing to them to use their influence with the Italian Government for the ex-

* See *Journal*. vols. II., pp. 500, 748; III., pp. 159, 547, 646, 714, 783; IV., pp. 104, 205, 333, 379, 535, 699, 738, 760; V., p. 597; VI., pp. 465, 484; VII., pp. 24, 623, &c.
† See *Journal*, vol V., p. 113.

emption of the Benedictine Monastery of Monte Cassino from the operation of the law which has passed the Chamber of Deputies for the suppression of the monastic institutions. Our representative at Florence having communicated these addresses to the Italian Government, stating at the same time that the British Government sympathizes in the appeal, a reply has been received from the Government of Italy to the effect that although the existing law on the subject cannot be materially modified, there is an article in that law which "has provided for the preservation of the above-named monastery as an artistic monument, and the King's government will not fail to avail itself of the discretion which is left to it to preserve from all injury the monuments contained in the Abbey of Monte Cassino. Thus the desire of Her Majesty's Government will be satisfied by the Italian Government as far as can be done consistently with the dispositions of the law which the Government is called upon to execute." The article referred to is as follows:—"The Government will be careful to preserve the edifices, with their appurtenances, libraries, archives, objects of art, scientific instruments, and the like, belonging to the Abbeys of Monte Cassino, the Cava dei Tirreni, San Martino della Scala, Monreale, the Carthusians near Pavia, and other similar ecclesiastical establishments distinguished by their monumental importance, and by the possession of literary and artistic treasures. The expense of keeping them up will be at the charge of the ecclesiastical fund."

Correspondence.

Paris Exhibition of 1867.—Heating and Lighting.—Sir,—By a miscopy or a misprint, a supercilious affront is conveyed in my letter inserted in the *Journal* of last week, on the testing of heating and lighting apparatus for the International Exhibition, in which letter the expression, "little-*heeded* traders' pretensions," is changed into "little-*headed* traders' pretensions." The object of the proposed competition for space by well devised qualities (instead of mere forms), tested by competent and impartial authorities, is to ensure that real merit shall be duly heeded by the public. As the Imperial Commissioners have been pleased to approve of the suggestion, and have determined to make provision for carrying it out practically, I hope that British manufacturers will respond to the invitation which will be authoritatively given to them. I may state that a committee has been appointed by Her Majesty's Commissioners, comprising British engineer officers, to direct the testing of cooking and warming appliances for the British army, with naval officers, to superintend the trials of cooking and other apparatus for the British navy, and other members have been appointed, specially with the view of judging of the trials that may be made of appliances for domestic and other civil purposes. I would submit to the consideration of the Council of the Society of Arts whether they might not aid the object, by offering prizes for the best cottage ranges, and others which are not the highest in commercial profit and promise of manufacturing attention. I believe that the principle of a competitive examination to test the qualities of objects, for which space is to be allotted in the Exhibition, may be advantageously applied to other classes of subjects. Two other classes, which have been brought under my particular observation, I have submitted for consideration. Such previous carefully-conducted examinations will, I believe, greatly facilitate and improve the service of jurors—a service which, in my experience as a juror in France and in England, at International Exhibitions, it has hitherto been commonly very difficult to render satisfactorily towards the public as well as towards exhibitors.—I am, &c., Edwin Chadwick.

Richmond, Surrey, S.W., August 20th, 1866.

Patents.

From Commissioners of Patents' Journal, August 17th.

Grants of Provisional Protection.

Anti-acid oil—1633—W. B. Brown.
Card cloth—1826—J. Moseley.
Cutlery handles—1742—F. Kahnt and J. Bunting.
Dress, fastenings for—1860—E. Drucker.
Fibrous substances, preparing, &c.—1850—L. J. Crossley and J. Sunderland.
Fibrous substances, spinning, &c.—1862—T. Westley and T. R. Beaumont.
Fire arms, breech-loading—1828—K. H. Cornish.
Fluids, forcing—1788—E. H. Aydon and E. Field.
Folding chairs—1836—A. V. Newton.
Fruit, dressing—1856—R. Soans.
Furnaces—1813—G. W. Hawksley, M. Wild, and J. Astbury.
Gas burners—1866—W. E. Gedge.
Gas retorts—1854—A. R. Stark and J. Woodman.
Grease cups—1832—W. Clark.
Guns, preventing the fouling of—1852—W. Ager.
Horses' nosebags—1818—F. Degravel.
Lamps—1872—J. Moffat.
Liquids, cooling—1834—M. J. Roberts.
Locomotive engines—1830—J. Ward and J. Smales.
Maps, rollers for—1893—W. S. Davis.
Motive power—1822—R. W. Fraser.
Motive power engines—1848—W. Justice.
Oxalic acid—1969—F. C. Hills.
Pneumatic railways—1844—T. W. Rammell.
Sewage, separating the fluid and solid parts of—1820—C. E. Austin.
Sewing and button hole machines—1876—F. Tolhausen.
Sewing machinery—1874—N. Salamon.
Shale, &c., decolorising the products obtained in distilling—1838—J. Law.
Silk waste, treating—1727—S. C. Lister.
Soda and potash, sulphates of—1917—G. Davies.
Steam engines—1824—W. Naylor.
Steam slide valves—1939—W. E. Kochs.
Steam travelling cranes—1842—R. Roger.
Timber, preserving—1846—A. Prince.
Travelling bags—1858—E. Heusser.
Velocipedes—1981—E. Gilman.
Walking sticks, &c., tipping with glass—1961—J. J. Wheeler.
Wrought iron—1868—G. Plant.
Yarn, spinning—1864—A. V. Newton.
Yarns, winding, &c.—1911—T. Andrews.

Patents Sealed.

517. J. Nall.
520. T. Kennedy.
522. G. and D. Hill.
524. J. A. Warwick.
530. H. S. Swift.
538. W. Webb.
539. H. S. Swift.
543. N. R. Hall.
546. M. & J. Robinson & W. Smith.
548. J. Walker.
559. W. Tongue.
631. W. R. Lake.
637. J. Carpenter.
680. W. R. Lake.
872. A. V. Newton.
880. W. T. Eley.
1549. C. McFarland.
1602. J. Holloway.

From Commissioners of Patents' Journal, August 21st.

Patents Sealed.

545. J. D. Brunton.
562. J. Dodge.
573. J. I. Barber.
574. T. Bulley.
576. T. Spencer.
577. J. Petrie, jun.
579. F. C. and C. E. Winby.
581. P. H. Lealand.
582. I. L. Pulvermacher.
588. F. M. Jennings.
594. W. E. Gedge.
603. H. Robertson.
609. J. Hick.
613. J. Norman and J. Copeland.
625. J. Young.
732. G. Phillips.
1199. J. L. Davies.
1327. J. A. Jones.
1452. T. Greenwood.
1609. S. Kilby and G. Dixon.
1684. W. Welbourne.

Patents on which the Stamp Duty of £50 has been Paid.

2020. P. F. L. B. Him.
2056. C. G. Wilson.
2008. C. Schiele.
2026. E. Lord.
2051. J. Yates.
2055. C. H. McCormick.
2045. J. Arthur.
2050. A. Cruickshank.
2071. J. Platt and W. Richardson.
2078. R. A. Brooman.
2080. R. Griffiths.

Patents on which the Stamp Duty of £100 has been paid.

1958. E. Rettig.
1936. T. Briggs.
1908. J. Fowler, jun., R. Burton, D. Greig, jun., E. E. Allen, and W. Worby.
1991. J. Chatterton.